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COOPERATIVE BACTERIOLOGICAL STUDY UPPER CHESAPEAKE BAY DREDGING SPOIL DISPOSAL

Federal Water Pollution Control Administration
Annapolis, Maryland

1968

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COOPERATIVE BACTERIOLOGICAL STUDY

UPPER CHESAPEAKE BAY DREDGING SPOIL DISPOSAL

by the

Chesapeake Field Station
Federal Water Pollution Control Administration

and

Chesapeake Biological Laboratory
Natural Resources Institute
University of Maryland

CRUISE REPORT NO. II

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Chesapeake Field Station
Middle Atlantic Region
FWPCA
Department of the Interior

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BACKGROUND:

The joint investigation was conducted to determine the effects of current overboard disposal of dredging spoil on the ecology of the bay in the shipping channel between Baltimore and the Chesapeake and Delaware Canal. Bacteriological capability was furnished by the Chesapeake Field Station, FWPCA, while all other aspects of the program were accomplished by the Chesapeake Biological Laboratory.

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FIELD PROCEDURE:

On March 15, 1968, a sampling boat from Chesapeake Field Station occupied stations above and below the dredge in the shipping channel of Chesapeake Bay off Stillpond Creek (map, Figure 1). Due to high winds the previous two days, the Chesapeake Field Station crew was not able to sample concurrently with the Chesapeake Biological Laboratory study vessel "Orion." The winds abated considerably during the evening of March 14; consequently, it was decided to attempt to evaluate patterns of suspended materials, as measured by turbidity, and the bacteriological parameters on the following day.

The initial transect location was estimated to be approximately 500 yards above the dredge by the use of landmarks and U. S. Coast and Geodetic Survey chart No. 572. Transects below the dredge were likewise approximated 500 yards apart by visual landmarks. Surface and 15 foot samples were retrieved at each of five stations on each transect in sterile sample bottles, iced and returned to the laboratory at Annapolis for bacteriological analysis and turbidity determinations.

The sampling run was started at 1300 and finished at 1445 hours EST.

The tide was ebbing while sampling. Wind was from the south, 10 to 20 miles per hour, and the water surface choppy. There had been no precipitation during the previous 48 hours.

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LABORATORY PROCEDURE:

Total bacterial population densities were estimated as plate counts on Difco Plate Count agar (Standard Methods Agar). Since this area is a region of relatively low salinity, all media were made with distilled water rather than with water from the environment. The pour plate method was used, plates inverted and incubated for 44 hours at 20°C, then counted with a Quebec colony counter.

Coliforms and fecal coliforms were estimated with the 5 tube-3 dilution MPN technique as outlined in Standard Methods (1965).

Water samples were analyzed for turbidity using a Hach nephelometric photoelectric turbidimeter. Results are expressed in Jackson turbidity units (JTU).

Resulting data are shown in Table 1.

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DISCUSSION:

Contours of turbidity distribution are shown on the idealized sampling plot, Figure 2. It is indicated from the distribution of these data that a tongue of turbid water, apparently emanating from the spoil pipe at a point approximately three-quarters of it's distance from the dredge, was distributed diagonally across the study area in the bottom waters and upwelled to the surface approximately 1,000 yards downcurrent from the point source.

The Secchi disc readings in Figure 3 showed a less detailed distribution, but the same general distribution as turbidities.

If it can be assumed that the elevated turbidity readings were due to overboard disposal of dredged spoil, statistical analysis should indicate whether the bacterial populations, as measured on standard plate counts, were significantly greater in the waters influenced by overboard spoil disposal. The plate counts, top and bottom, at stations II-4, III-3, III-4, IV-4, IV-3, IV-2, and V-5 in the area of elevated turbidity readings, were compared with all other stations. The mean bacterial count in the plume, 612.86 bacteria/ml was significantly different from the mean bacterial count of all other stations, 362.48 bacteria/ml ($t=2.51^{*}$, $d.f.=43$). This would indicate that, in the waters in the approximately one-half square mile observed to be affected, a doubling of the bacterial populations occurred. Actually this may be a conservative figure, for it is probable that bacterial populations in the waters surrounding the plume

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were slightly higher than usual due to the continuous activity of the dredging operation and the effects of high winds in distributing disturbed sediments on previous days.

A regression analysis of turbidity and bacterial plate counts is shown in Figure 5. As would be expected, there was a tendency toward increased counts with increased turbidity.

The populations of coliform bacteria did not show trends comparable with the total plate counts. The areas of increased coliform populations seemed to be down-current of the dredge rather than the spoil effluent, although a clearly defined pattern was not evident. This distribution may be due to any number of factors, such as the effect of the dredge agitator on the sediment-water interface where coliforms, if present, are likely to be; the possible contribution of coliforms from the work force on the dredge; the proximity of the dredge to the shipping channel, with contributions of coliforms from passing ships; or possible contributions from nearby shore installations.

The presence of fecal coliforms was nearly negligible, and are shown in Table 1, but were not plotted.

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TABLE I

CHESAPEAKE BAY DREDGING STUDY
March 15, 1968

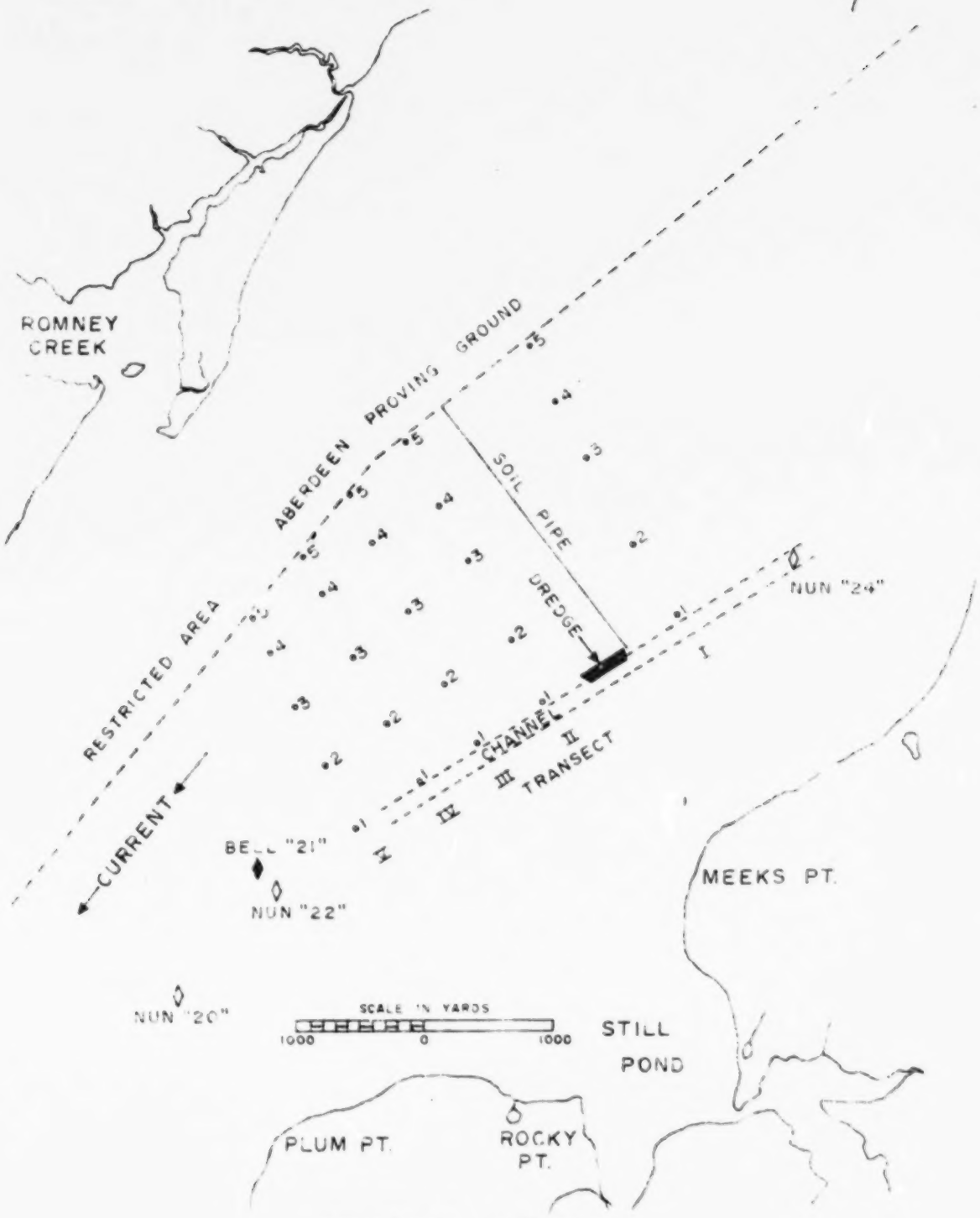
Location	Sample Number	Sample Depth Feet	Water Temp °C	Secchi Disc Inches	Plate Count bact/ml	Coliform MPN bact/100ml	Fecal Coliform MPN bact/100ml	Turbidity JTU
TRANSECT I								
Station 1	68031901	Surface	7	22	750	70	<20	17
	02	15	7	22	256	20	<20	21
2	03	Surface	7	22	304	20	<20	13
	04	15	7	22	178	<20	<20	20
3	05	Surface	5	24	232	50	<20	13
	06	Bottom	5	24	281	50	<20	26
4	07	Surface	5	24	145	<20	<20	14
	08	Bottom	5	24	183	<20	<20	57
5	09	Surface	4.5	15	186	80	<20	20
	10	Bottom	4.5	15	780	20	<20	62
TRANSECT II								
Station 5	68031911	Surface	4.5	12	580	80	<20	27
	12	15	4.5	12	222	20	<20	58
4	13	Surface	4.5	12	113	50	<20	16
	14	15	4.5	12	467	50	<20	90
3	15	Surface	4.5	15	538	20	<20	13
	16	15	4.5	15	344	110	<20	32
2	17	Surface	4.5	18	74	130	<20	13
	18	15	4.5	18	168	130	<20	33
1	19	Surface	4.5	18	102	110	<20	16
	20	15	4.5	18	162	20	<20	22

TABLE I (Continued)

Location	Sample Number	Sample Depth Feet	Water Temp °C	Secchi Disc Inches	Plate Count bact/ml	Coliform MPN bact/100ml	Fecal Coliform MPN bact/100ml	Turbidity JTU
TRANSECT III								
Station 1	68031921	Surface	4.5	18	65	20	<20	15
	22	15	4.5	18	182	140	<20	22
2	23	Surface	4.5	15	115	20	<20	12
	24	15	4.5	15	212	110	<20	27
3	25	Surface	4.5	15	258	70	<20	20
	26	15	4.5	15	348	20	<20	80
4	27	Surface	4.5	10	249	50	<20	50
	28	15	4.5	10	790	20	<20	85
5	29	Surface	4.5	10	339	50	<20	30
	30	15	4.5	10	832	170	<20	45
TRANSECT IV								
Station 5	68031931	Surface	4.5	12	350	<20	<20	22
	32	15	4.5	12	910	20	20	43
4	33	Surface	4.5	10	1280	80	<20	47
	34	15	4.5	10	1220	20	<20	75
3	35	Surface	4.5	10	301	20	20	38
	36	15	4.5	10	830	130	20	83
2	37	Surface	4.5	10	476	80	<20	24
	38	15	4.5	10	1230	80	<20	84
1	39	Surface	4.5	10	722	170	<20	21
	40	15	4.5	10	937	80	<20	37

TABLE I (Continued)

Location	Sample Number	Sample Depth Feet	Water Temp °C	Secchi Disc Inches	Plate Count bact/ml	Coliform MPN bact/100ml	Fecal Coliform MPN bact/100ml	Turbidity JTU
TRANSECT V								
Station 1	68031941	Surface	4.5	10	190	50	<20	17
	42	15	4.5	10	748	20	<20	60
2	43	Surface	4.5	10	850			32
	44	15	4.5	10	550			31
3	45	Surface	4.5	10	468			93
	46	15	4.5	10				44
4	47	Surface	4.5	12				44
	48	15	4.5	12				18
5	49	Surface	4.5	12				29
	50	15	4.5	12		110	<20	18



STUDY AREA

UPPER CHESAPEAKE BAY
CRUISE NO. 2

Figure 1

CONTOURS OF TURBIDITY DISTRIBUTIONS
ON IDEALIZED SAMPLING AREA
CHESAPEAKE BAY 3/15/68

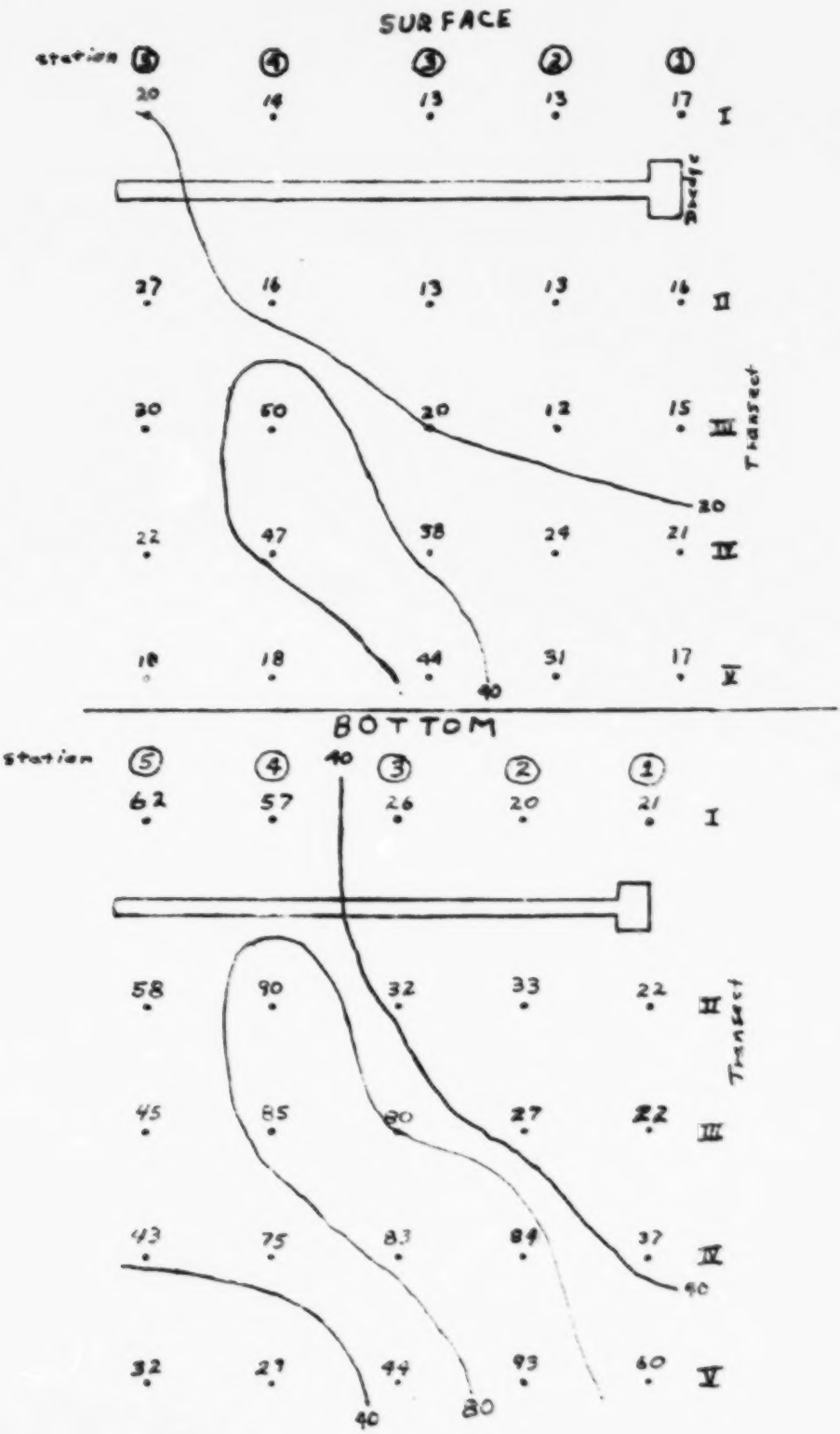


FIGURE 2

CONTOURS OF SECCHI DISC READINGS (INCHES)
ON IDEALIZED SAMPLING AREA
CHESAPEAKE BAY 7/15/68

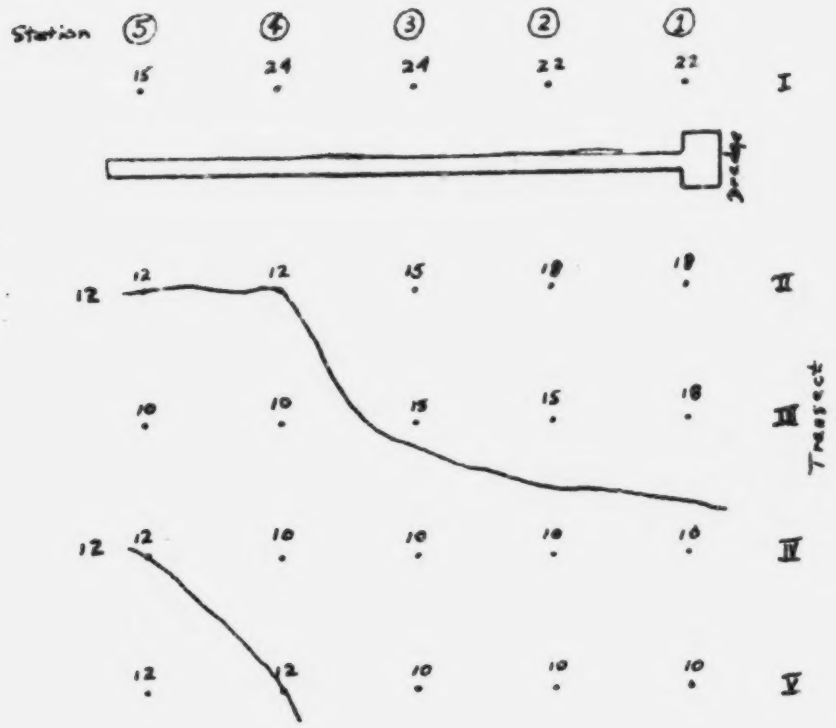


FIGURE 3

CONTOURS OF BACTERIAL PLATE COUNTS
ON IDEALIZED SAMPLING AREA
CHESAPEAKE BAY 8/15/68

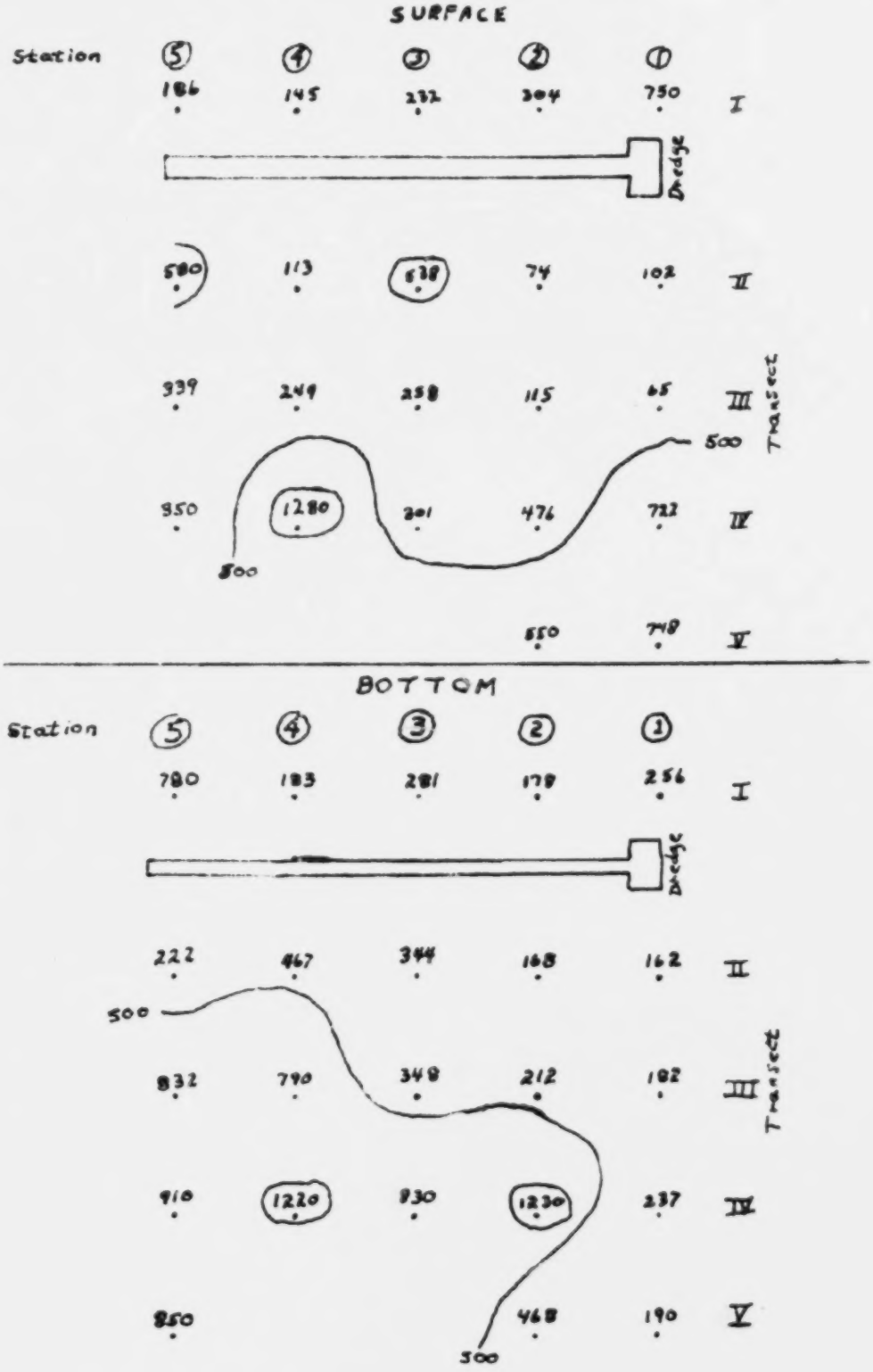


FIGURE 4

Regression of bacterial plate counts and turbidity.

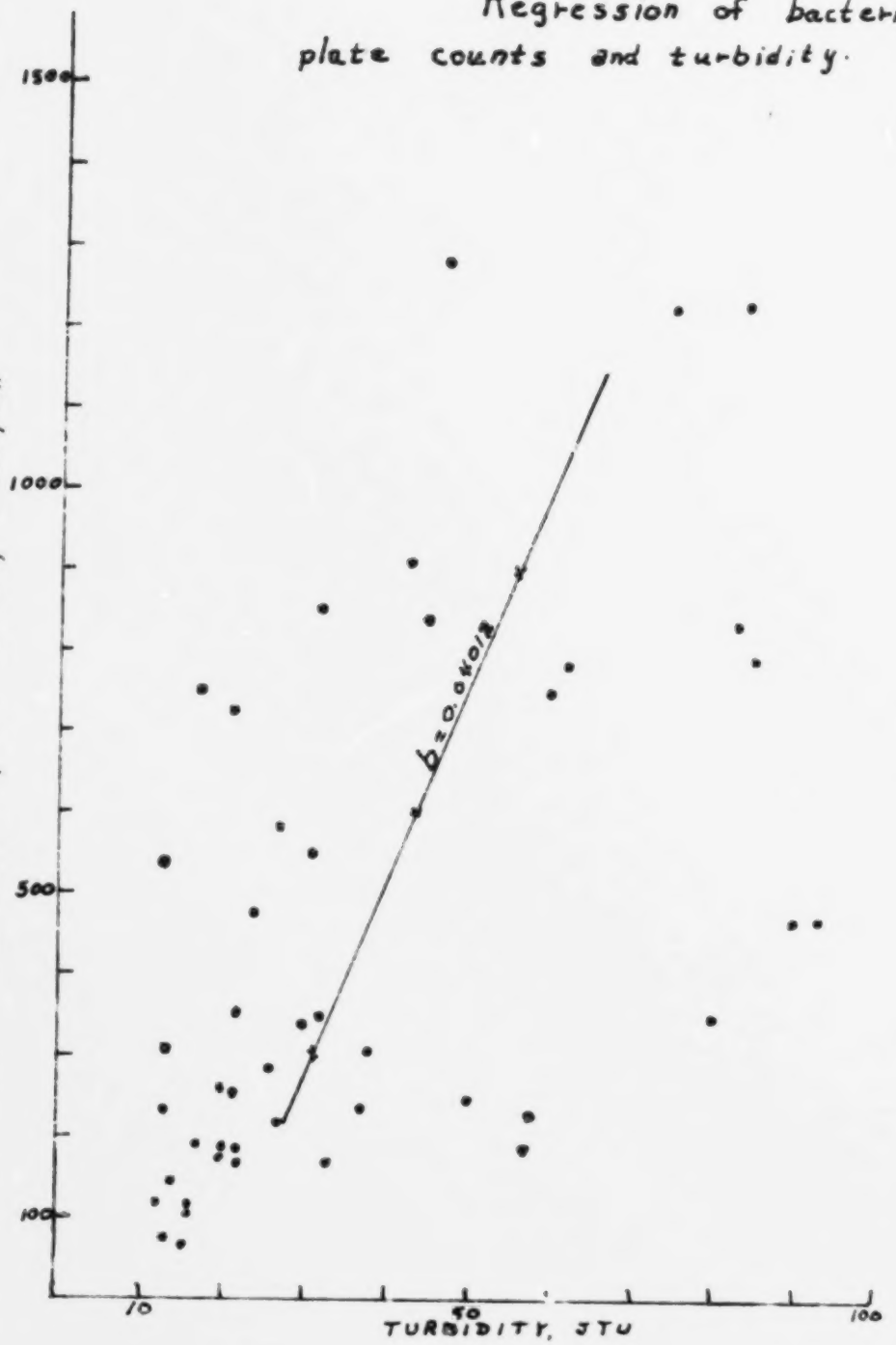
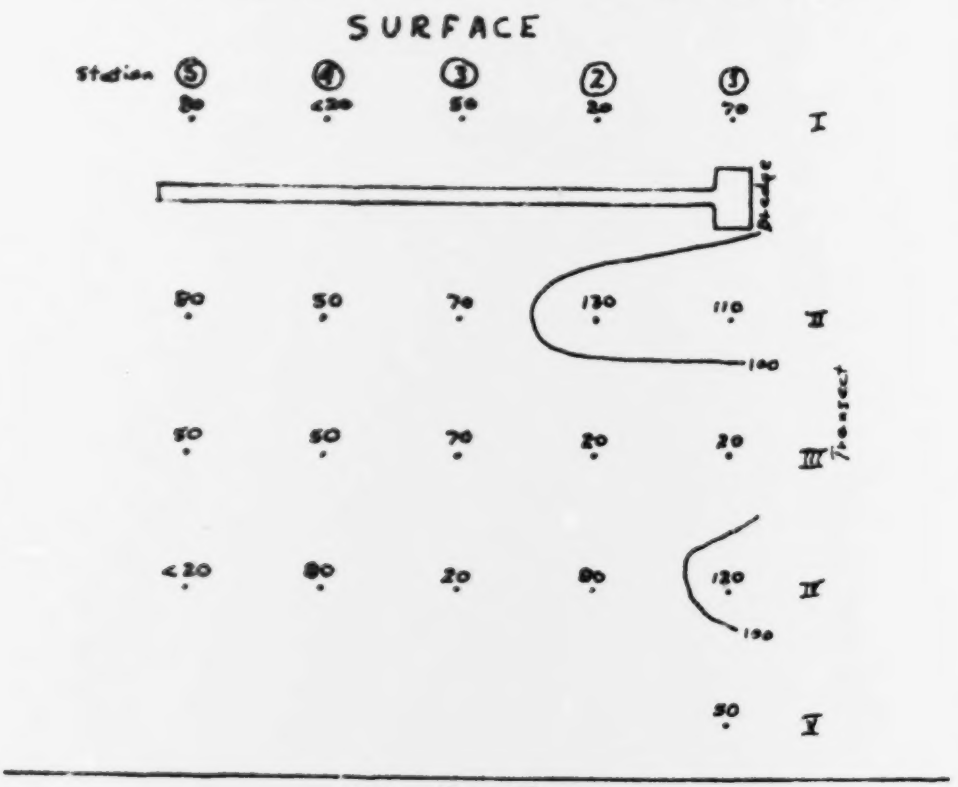


FIGURE 5

CONTOURS OF COLIFORM MPN ON
IDEALIZED SAMPLING AREA CHESAPEAKE BAY 3/15/68



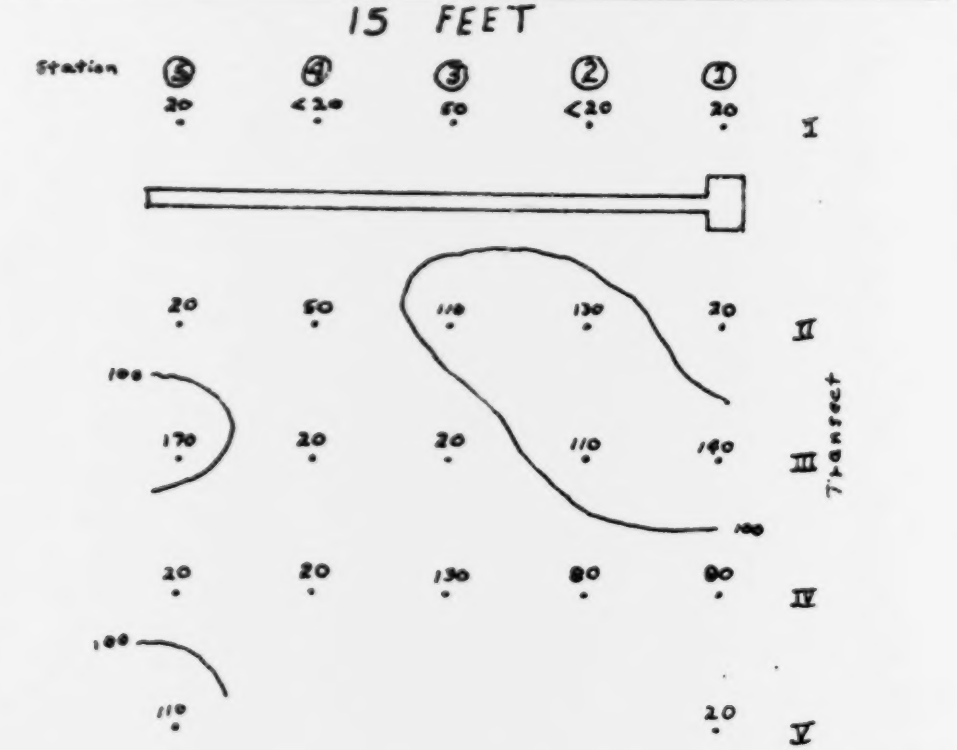


FIGURE 6